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ABSTRACT

This review of the historical development and use of instructional television at Worcester Polytechnic Institute concentrates on the use of videotape as supplementary to classroom instruction in scientific and technical subject areas. Uses of videotapes discussed include: (1) instruction in computer use, (2) laboratory module instruction, (3) instruction in technical equipment operation, (4) student developed videotapes, and (5) videotaping of lectures for student re-viewing and for off-campus continuing education students. Closed circuit television for individualized instruction, and telecourses are also discussed, and equipment and facilities are described. (STS)

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HISTORICAL DEVELOPMENT AND USE OF INSTRUCTIONAL TELEVISION AT WORCESTER POLYTECHNIC INSTITUTE

1977

Kenneth E. Scott[1]

Experiments involving the use of instructional television were initiated in the Chemistry Department and the Mechanical Engineering Department at Worcester Polytechnic Institute approximately eight years ago. The extra large freshman class of September 1968 necessitated the use of CCTV in Chemistry lectures. At about the same time, experiments were being conducted in the Mechanical Engineering Department primarily concerned with the use of television to improve instruction in undergraduate courses. As a direct result of these initial experiments in the Mechanical Engineering Department, a further commitment was made during the summer of 1969 in the form of the acquisition of a limited amount of improved television equipment.

During the fall term of 1969 the enrollment in a course in control engineering in the Mechanical Engineering Department increased to a point where it was impossible to schedule an analog computer laboratory in the traditional manner. It was decided to allow students to use the analog laboratory whenever they wished on a 24 hour basis, and to use videotape as a means of answering the thousand and one questions that always seem to arise whenever a student patches a board and operates the computer for the first time. The normal number of introductory lectures and instruction on the use of the TR-20 analog computer were still given. The big change was that the students could reserve the use of the TR-20, sign out a key for the laboratory and do their assigned problems whenever they chose. By careful scheduling of assigned problems, it was possible to accommodate up to 100 students in the analog laboratory with only one TR-20 analog computer.

A television "viewing station" consisting of a television monitor and a videocorder was available in the laboratory adjacent to the TR-20 computer. A videotape was specifically prepared for "hands on" use by the students using the TR-20 analog computer. A student could choose to view the tape just before he began patching a board and/or operating the computer, or he could dive right in and use the videotape to answer a particular question that may come up as he progressed. The videotape was indexed so the student could "fast forward" or "rewind" after checking the index, making it unnecessary to view the entire videotape. The videocorder has a "pause" option, allowing the student to stop the tape and thoroughly check a point whenever he chooses.

Even though instructors were available during normal hours, the students were encouraged to use the videotape to obtain answers to their questions. The availability of the videotapes permitted operating the laboratory 24 hours a day, seven days a week, thereby simultaneously increasing the efficiency in the use of the computer and improving the quality of learning. Each student was able to spend as much time as he wished learning how to program and operate the computer. Loaning keys to students increased their feeling of responsibility in using the equipment and helped to reduce maintenance costs. The experiment was very successful and favorably accepted by the students.

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The outstanding success of this first "hands on" student use of videotape encouraged other faculty to experiment in the use of videotape to improve student learning. Soon thereafter, the Mechanical Engineering Department offered to help anyone on campus desiring to experiment with the use of television as a means of improving instruction in undergraduate courses. The instructor teaching a basic laboratory course in nuclear engineering normally spends many hours detailing the use of the radiation analyzer and other sophisticated radiation detection devices, either to small groups of students or individual students. He soon found out that by videotaping such instructions and placing a viewing station in the nuclear laboratory adjacent to the instruments, he was immediately freed from repetitive drudgery, and had more time to devote to personal contact with his students. Today, there are over 50 videotapes available for "hands on" student use in this satellite viewing station in the nuclear laboratory as shown in Figure 1 below. Many "how to do it" videotapes have been produced to date

Figure 1: Student viewing "how to do it" videotape in the Nuclear Laboratory

for "hands on" student use at many different locations on campus. Presently, there are satellite viewing stations in the laboratories, in project centers, in the machine shop, etc. Any faculty member can make a request to the TV

studio for a viewing station. Most requests are fulfilled immediately providing the equipment is available and the location has reasonable security. For example, the oral communications instructor has a viewing station in her office which she uses during conferences with her students to review and critique their speeches. The number of satellite viewing stations varies on a term-by-term basis, normally averaging somewhere between 10 and 20.

Individualized Instruction

In 1971, Worcester Polytechnic Institute committed itself to an extensive and bold new educational program for engineers and scientists. One important facet of the new educational program called the WPI PLAN was a new approach to learning called Individually Prescribed Instruction (IPI)[2]. The IPI method of instruction is a complete change from the usual lecture-instructor classroom centered instruction to a student-centered, self-paced instruction. A student working in a no punishment situation proceeds at his own pace through a course hierarchy mastering the course material one unit at a time. The only requirement is that the student must be able to demonstrate his ability in the prerequisite unit before moving on to the next unit and more advanced material. When a student feels he is ready, he comes to the Learning Laboratory where he takes an individually prescribed assessment on that unit. The assessment is immediately corrected in a one-to-one student instructor or proctor relationship. If the student demonstrates a mastery of the material, he is passed and immediately rewarded with the next unit of instruction. If not, he is recycled. Each study unit contains an introduction, a well-defined set of behavioral objectives, a list of instructional aids, illustrative problems with answers, and the response desired of the student. The instructional aids may include a primary course text, reference texts, programmed learning manuals, videotapes, audiotapes and digital computer programs. The student in this method of instruction experiences a high degree of freedom with respect to how, what, where and when he studies.

Initially, courses in control engineering and physics were offered using this method of instruction. The control engineering course placed heavy reliance on multimedia instructional aids. The most useful and valuable instructional tool proved to be videotape. Although some tapes were prepared in advance to present certain types of material, the instructors of the course found an unexpected student demand for many short videotapes. Students wanted tapes to clarify points, explain principles, or just detail a shortcut approach. Because of the development of the IPI course, two distinct types of viewing stations were needed. In addition to those being used in laboratories, there suddenly was a need for viewing stations for general student use in the school library.

During the spring term 1970-71, one viewing station was located in the library. Only a few courses were being offered using this new method of instruction (IPI), and this first effort involving the use of television as an instructional aid was considered an experiment. Only 200 students were involved in IPI courses during the spring term 1970-71.

During the summer of 1971, additional courses were planned utilizing IPI and many more videotapes were produced. A small room in the library was prepared to accommodate viewing stations. By the spring of 1972, student

[2]The WPI PLAN: A Case Study; Kenneth E. Scott, Robert A. Peura, and James S. Demetry.

demand had increased to the point where five viewing stations were constartly busy and the room was overcrowded. During the summer of 1972, a much larger Learning Center was prepared in the library capable of holding up to 20 viewing stations. Normally, there are between 15 and 20 viewing stations in this Learning Center in the library, and over 1,000 videotapes are available for "hands on" student use as shown below in Figure 2. Additional space will become available for expansion of the Library Learning Center in September of 1976 when the night study area which is now in an adjacent room is relocated in Salisbury Laboratory. This will make it possible to increase the number of viewing stations and also provide one or two small rooms where groups of students will be able to view videotapes and carry on discussions without disturbing other viewers.

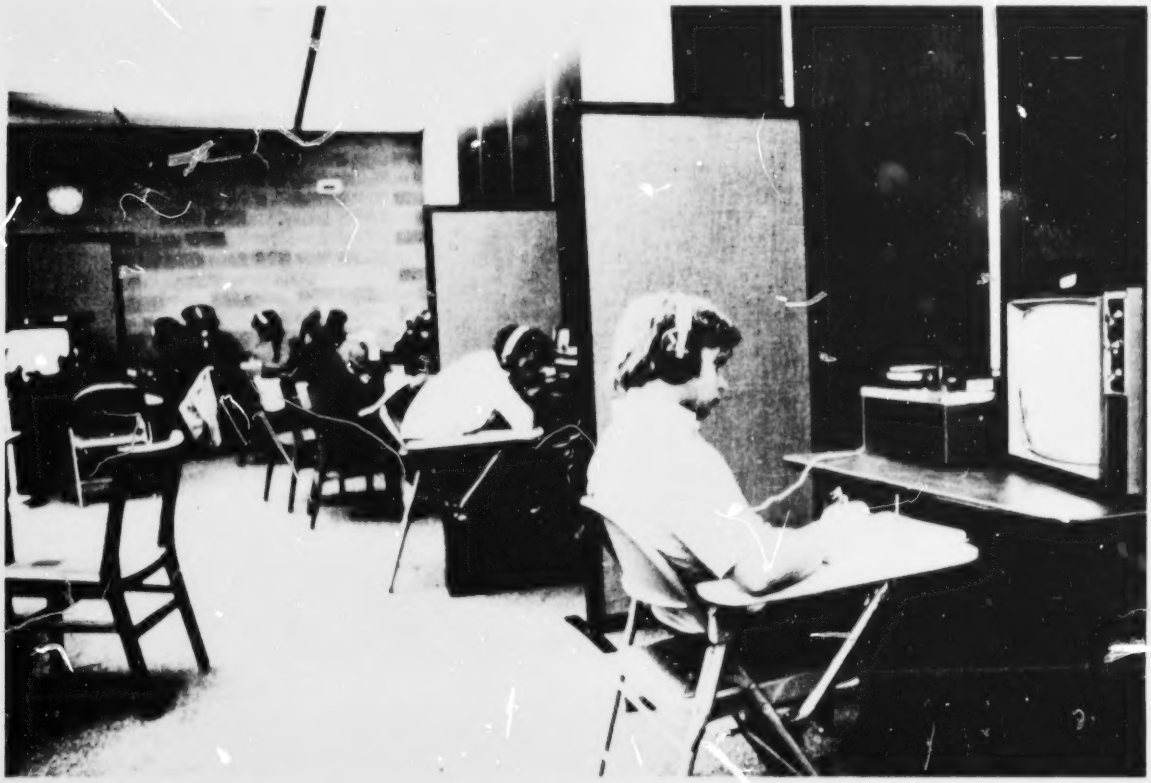

Figure 2. Students viewing videotapes in Library Learning Center

The use of videotape is not limited to supporting the 20 or so IPI courses that are normally offered yearly at WPI. Over 80 different courses effectively utilize television as a learning aid, for under the WPI PLAN more learning on their own is expected of all students. There has also been an increase in the use of television in project activity. Furthermore, over 50% of all faculty at WPI are involved one way or another in the use of television in their courses or project activity.

A List of Videotapes is published periodically by Gordon Library noting course, faculty, and subject matter. Reference to this list will provide an insight

into the extent to which television is being successfully used on the WPI campus as a learning aid.

Average daily use of videotape in the Learning Center has been as follows during the last three academic years.

	1973-74	1974-75	1975-76	1976-77
Term A	101	104	96	111
Term B	74	76	73	85
Term C	73	80	71	68
Term D	46	53	51	37

A "use" consists of one or more students selecting and viewing a videotape. Each "use" is recorded by a member of the library staff assigned to supervise the operation of the Learning Center. A summary of "uses" for the last five academic years is shown below in Figure 3. Note that from September 1971 through August 1976 there were a total of 62,897 uses. The information is also used to determine individual videotape use. Heavily used and, consequently, worn videotapes are replaced with new duplicates, and little used videotapes are removed from the videotape library after receiving permission of the faculty member concerned.

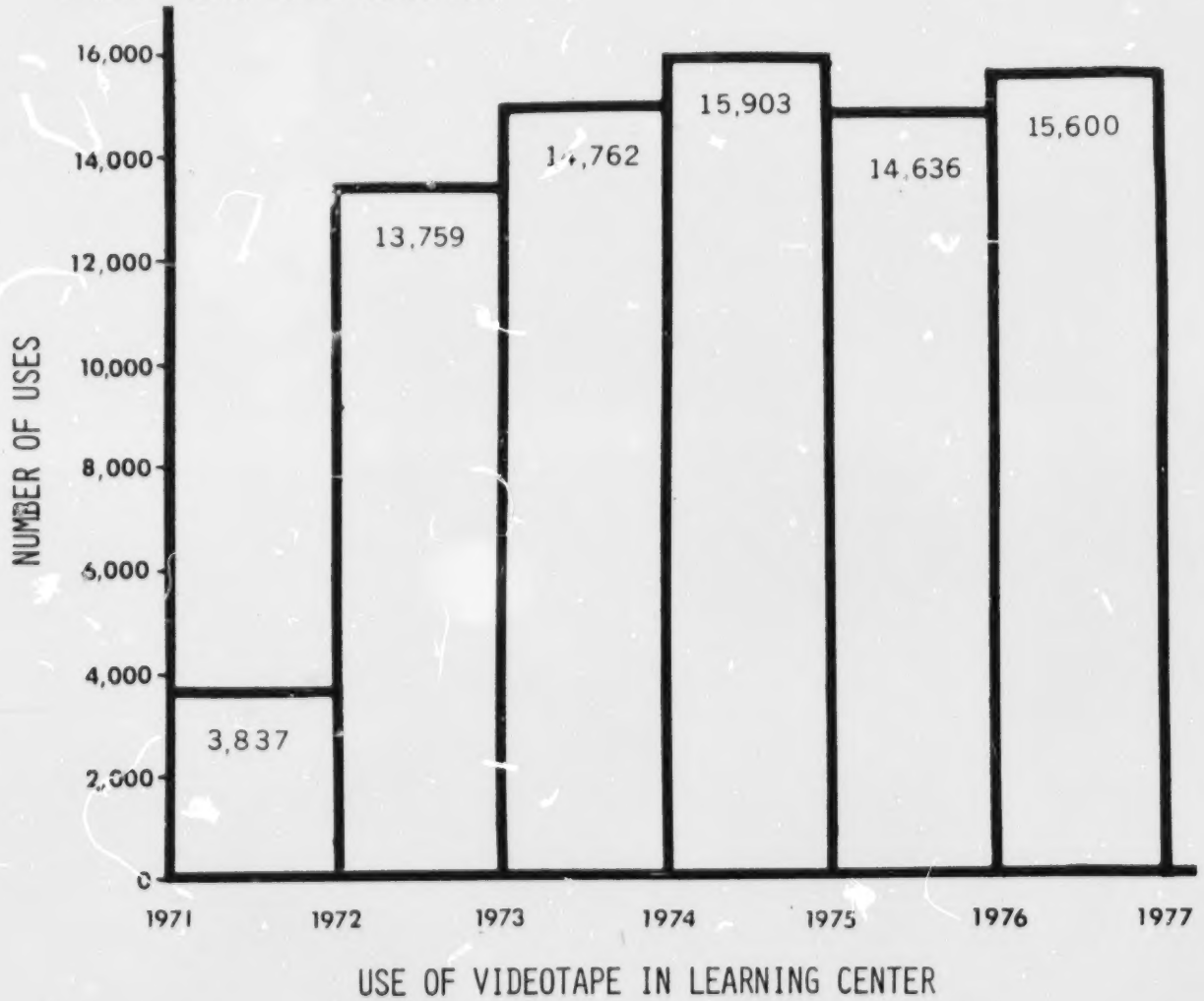

Figure 3.

Modular Learning Laboratory[3]

The new education program at WPI requires heavy student involvement in projects, increasing the need for some form of instrumentation and measurement support for our students. The traditional laboratory approach can no longer satisfy this need which is so varied in content and unbounded by time. Project Instrumentation and Measurements Experimental Learning Laboratory (PIMELL) was initiated at WPI to satisfy this need. PIMELL essentially consists of a series of Learning Lab Modules specifically designed to support students participating in project and independent study activity. Each Learning Lab Module has its designated area in an "open" laboratory where students of all disciplines can come to obtain information, practice using instruments and equipment, make measurements, and, eventually, select that method and instrument consistent with their project or independent study activity. All learning is programmed, self-paced, and "hands on" with heavy reliance on the use of videotape.

A typical Learning Lab Module now in operation details the methods of measuring humidity. Samples of instruments for measuring humidity are conveniently available for the students to use in the laboratory. For example, at present an Alnor Dewpointer, a sling psychrometer and a hygrometer are available. An integral part of the Learning Module is a television viewing station. Prepared programmed materials guide the student in the use of the humidity measuring instruments. The use of each instrument is detailed on videotape, and the student is encouraged to obtain experience using each instrument. Once a student has become familiar with the methods available to measure humidity, he may sign out an instrument of his choice consistent with his project activity and use it.

In another portion of the laboratory, a student is learning how to measure temperature. He is viewing a videotape which illustrates how to make a thermocouple. All the necessary information, supplies, and equipment are available for the student to practice using thermocouples as a means of measuring temperature.

The use of Learning Lab Modules is not limited to instrumentation and measurements. The need also exists for better and more economical methods of providing a means for students to learn how to use equipment such as the TR-20 Analog Computer, the oscilloscope, and to learn good soldering techniques and how to write a professional report. Figure 4 on the following page shows a student utilizing Learning Lab Module AC. Presently, there are over twenty Learning Lab Modules available for student "hands on" use on a wide range of topics, and additional modules are planned. An area in Higgins Laboratories (ME) and Olin Hall (Physics) has been designated to accommodate these Learning Laboratories.

The Learning Lab Modules are also used as support material in ME 2901, Engineering Experimentation, and PH 3603 and PH 3604, Advanced Physics Project Laboratory, courses that provide laboratory experience for our students.

The PIMELL program provides students in engineering and science with the opportunity at a time of their choosing to obtain the knowledge and skills required to meet the challenge of increasing emphasis on project and independent study activity at WPI. This concept satisfies the trend in education today away from the traditional approach to one where learning is the constant and time is the variable.

[3]Use of Videotape in Laboratory Instruction; Kenneth E. Scott, American Society for Engineering Education, Annual Conference, June 28, 1973.

Figure 4. Learning Lab Module AC, Analog Computer Simulation

Videotaping Courses

The use of television at WPI is not limited to producing videotapes to supplement course and laboratory instruction. Several courses have been completely videotaped for use off campus. A special course on The Nuclear Power Controversy was videotaped during the spring term 1971-72[4]. The course was sponsored by the U. S. Atomic Energy Commission and Yankee Atomic Electric Company, and was designed for high school teachers, education majors and other non-engineering persons. The resulting 38 hours of videotape were edited down to 18 videotapes between 40 and 50 minutes in length. The videotapes have been used by over 50 high schools and colleges and requests are still being received to use these videotapes. An entire course in Marketing Engineering has also been videotaped. During C and D terms of 1974 a graduate course on electric power systems was videotaped on 3/4" videocassettes. The class was small and met in the TV studio. This course is not offered frequently due to small enrollments. In the future it will be available on videocassettes, and students will be able to enroll for the course under independent study. In addition, the course will be available for use in local industry. This type of activity will increase at WPI in the future.

[4]NE 7720, The Nuclear Power Controversy, Leslie C. Wilbur and James Hensel, 1972.

Television Productions

The TV studio staff occasionally work with faculty and students to produce high quality and sophisticated videotape productions. Every year during Intersession there is a Videotape Workshop involving approximately 10 students. The students are divided into production teams, and they produce a 15 to 20 minute videotape on a subject of interest to them. The students prepare their own script, learn how to operate all the equipment, do their own editing, etc. The main purpose of the Videotape Workshop is to provide an opportunity for interested students to learn how to produce a videotape. During a recent Intersession, one group of students produced a videotape on the life of a WPI student, and another on the Alternative School in Worcester.

An increasing number of students working on Interactive Qualifying Projects are utilizing videotape. In 1973 two students produced a videotape comparing the old and new Worcester County jails. Another student produced a series of videotapes summarizing and analyzing the Watergate crisis. The WPI TV studio staff during January of 1974 produced a short videotape on a heart monitoring system for use by a faculty member at a medical show. During June of 1974 a portion of a course on The Family sponsored by the Department of Community and Family Medicine at the University of Massachusetts Medical School was videotaped and made available on 3/4" videocassettes for use and evaluation.

The WPI TV studio staff is frequently approached by local community groups and organizations for help in producing and the use of videotape. Many of these organizations realize that the use of videotape would increase the effectiveness of their activities and programs, but they have neither the capability nor resources to properly utilize television at this time. It is the policy of the WPI TV staff to do whatever it can to aid these organizations.

Student groups under the supervision of the WPI TV studio staff have worked on Interactive Qualifying Projects in cooperation with the WPI-St. Vincent Hospital Internship Center. Figure 5, shown on the following page, is a composite of photographs showing students and phlebotomists videotaping venipuncture procedures. The Worcester Police Department asked the WPI TV studio staff to aid them in videotaping a series of presentations during one of their training sessions. The studio staff not only was able to assist the Police Department on this occasion, but as a direct result of this contact a student Interactive Qualifying Project was initiated consisting of working with the Worcester Police Department.

Recently students have been working on a research project with the speech pathologists at the Worcester County Hearing and Speech Center, Inc. Videotape is being used to achieve immediate feedback during therapy in hopes of speeding up the rehabilitation of aphasic patients. Figure 6 shows three students utilizing the portable TV studio to record on videotape a receptive language remedial program. The speech pathologist can be seen through the window of the door and on the upper left hand corner of the screen. Only the table top and the hands of the patient are shown on videotape to insure confidentiality.

Another group of students is experimenting with the use of videotape to accelerate learning for deaf engineering and science students.

During the last few years many different local community groups and organizations have contacted the WPI TV studio staff and indicated an interest in the use of videotape in their activities and programs. This type of interest in the use of videotape is on the increase, and it is hoped that grants can be

Figure 5. WPI students and phlebotomists at St. Vincent Hospital videotaping venipuncture procedures

obtained from private and government sources to enable the WPI TV studio staff to continue to react positively to requests for help and also to increase this sort of aid to local community groups and organizations in the future.

Cable Television on Campus (WPICTV)

Another logical step in the continued growth in the use of television at Worcester Polytechnic Institute has been the installation and operation of a closed-circuit cable system on campus (WPICTV). The main purpose of the cable system is to supplement the existing student "hands on" program described above. There presently exists the capability to originate programs from the TV studio, either live or using videotape, or to distribute normal broadcasts off the air. The cable system will further supplement the "hands on" use of television and aid learning as we implement the WPI PLAN. A TV bulletin board is in operation daily on channel 3 on the cable system.

Figure 6. WPI students videotaping receptive language remedial program

Beginning in February 1974, during the seven-week C term, an experimental program was initiated which involved videotaping the three lectures per week in MA 1030, Integration Methods and Infinite Series. The videotapes were shown over the cable system so that they could be viewed by students at various times and places on campus. Each new showing of an MA 1030 lecture was preceded by a showing of a previous lecture. The videotapes were also made available after the final showing on the cable system for "hands on" use by students in the Learning Center in the library. The students also attended two hours of conference with their instructor in small groups. Approximately 90 students were involved, and the evaluation at the end of the term provided mixed results. The experiment was repeated during D term 1974 with 100 students. During D term, each videotape was shown twice on the cable system and was also available at all times for "hands on" student viewing in the Learning Center in the library.

Instructional Television Videotapes

Instructional videotape production at WPI is kept as simple as possible. All videotapes are made by individual faculty members. A faculty member wishing to make a videotape calls the TV studio for an appointment. At the designated time, he either shows up at the TV studio to make the tape or portable equipment

is moved to his laboratory. In either case, the procedure for making a tape is kept as uncomplicated as possible and usually takes a minimum amount of time. It is normal practice to use the overhead camera in the mini-studio, the instructor writing on a specially prepared pad with a flare pen. Figure 7 shown below illustrates the procedure. The camera on the professor and the overhead camera are remotely controlled. The entire operation is controlled by one person, the TV Studio Supervisor or a student operator.

Figure 7. Faculty member making a videotape in the mini-studio with Herman Dumas, TV Studio Supervisor, at the control panel

Faculty are usually surprised at how little time it takes and how easy it is to make videotapes. It takes the faculty member twenty minutes to make a twenty minute tape, forty-five minutes to make a forty-five minute tape, providing no editing is required. Studio setup time is kept to a minimum, and experienced faculty members prepare for and make a videotape in the same way they would a normal lecture. However, the faculty member is able to preview the videotape immediately, add or delete material with ease, or do it all over again if he wishes. This seldom happens, and in most cases the videotape is being used by students in a matter of hours after the faculty member leaves the studio. We have had few complaints from the students on resolution and general quality of the videotape. The students are primarily interested in using the videotape as an aid to learning, and care little whether there is a fancy title, editing, etc.

Videotapes produced in the mini-studio can be recorded on 3/4" videocassettes, 1/2" or 1" reels. Normally, videotapes are recorded simultaneously on a 3/4" videocassette and a 1/2" videocorder. The 1/2" videotape goes immediately to the Learning Center in the library or to a satellite viewing station, and the 3/4" videocassette is kept as a master in the TV studio and is available for use on the cable system. A second 3/4" videocassette can be made simultaneously if an additional copy is needed.

The standard viewing station in the Learning Center and in the various satellite locations consists of a Sony 1/2" AV-3600 videocorder and a 19" monochrome monitor/receiver. These videocorders are reel-to-reel type and have proven to be very reliable. The TV studio staff carry on a regular program of preventive maintenance which includes keeping the videocorder heads clean, periodic checks on alignment, replacing belts, etc. as shown below in Figure 8. Maintenance is accomplished primarily by our student technicians under the direction of Mr. Herman Dumas, the TV Studio Supervisor. Consequently, overall maintenance problems have been kept to a minimum and the maintenance cost to date has been low.

Figure 8. A student technician repairing a Sony portable videocorder

A new viewing station costs approximately $1200.00 and includes the videocorder, the monitor/receiver and associated wiring. Occasionally, used AV-3600 videocorders become available, and recently ten were purchased for less than 50% of

list price. The adoption of the 3/4" videocassette as a standard and the trend toward color have contributed to the availability of used 1/2" videocorders and monochrome monitor/receivers. All used videocorders and monitor/receivers are thoroughly checked out by the TV studio student technicians under the direction of the TV Studio Supervisor. Any worn parts are replaced, and each videocorder is properly aligned prior to being placed in the Learning Center.

New 1/2" videotape costs less than $17.00 for a one-hour reel, a 3/4" UCA60 videocassette costs $20.00, a 3/4" UCA30 videocassette costs $14.00, and WPI mini-studio cost normally runs less than $50.00 per hour. The total cost of an original 30 minute instructional videotape made by a faculty member, including the 3/4" master, would be approximately $50.00, not including faculty preparation time. Most faculty spend about the same time preparing for a 30 minute videotape as they would preparing a normal lecture.

At least two of the 15 to 20 viewing stations in the Learning Center in the library are 3/4" videocassette playback units. One of these viewing stations consists of a videocassette playback unit without the pause option and a color monitor. This viewing station is used primarily for viewing color or monochrome videocassettes containing material not requiring the pause (still frame) option. The other viewing station consists of a videocassette playback unit with pause option and a monochrome monitor. Videocassette playback units are also used in locations such as the machine shop where dust and metal particles might be detrimental to the continual operation of the 1/2" open reel-to-reel type videocorders. The use of the 3/4" videocassette will increase in the future on the WPI campus.

Mini-Studio

Prior to May of 1975, most videotapes that were produced on campus were made in a single, modestly equipped TV studio. This studio could accommodate only very small groups of students and, therefore, tapes of live classroom situations could not normally be made. To alleviate this situation and also to generally facilitate videotape production on campus, the TV studio area was completely remodelled beginning in May of 1975.

A small mini-studio was designed and installed with its associated control room specifically to make it easy for a faculty member or student to make a videotape. These videotapes are used primarily to support courses, laboratories and project activities. This mini-studio utilizes an overhead camera capable of remote control of pan, tilt and rotate in addition to lens functions such as zoom, lens opening and focus. A second camera mounted on a wall is used to record the instructor sitting at the desk. Additional cameras can be easily connected into the system for use on special productions.

The recent acquisition of a Sony VO-2850 and RM-400 automatic editing system has greatly improved the editing capabilities. This new editor is located in control room B which serves the newly installed mini-studio.

Control room B in conjunction with the mini-studio will be used extensively by students utilizing videotape in their project activities.

A large matrix type video switcher is also housed in control room B. The switcher is used to distribute video signals throughout the entire campus. For example, by pushing the correct button it is possible to select the TV

Bulletin Board or the output of a 3/4" videocassette recorder and distribute the signal either on channel 3 or channel 5 of WPICTV.

Instructional Television Classroom

An important consideration in the remodelling of the TV studio during the summer of 1975 was the need for an Instructional Television Classroom where a live classroom situation could be videotaped. The area normally used for a TV studio was converted into an ITV classroom capable of seating 36 students as shown below in Figure 9. Although this ITV classroom, with control room A, has been specifically designed to accommodate a new program called WPI Continuing Education through Videotape (WPI CETV), it will also be used for videotaping a wide range of activities including undergraduate courses, seminars, project presentations, etc.

Figure 9. Videotaping a class in CM 3201, Kinetics and Reactor Design, using the ITV classroom and control room A.

The room has a stepped (raised) floor with fixed seating for 36, carpeting and drapes for noise control, special lighting, and is centrally air-conditioned. Each pair of students share a monitor to allow them to view material written on a special pad on the instructor's desk with a felt pen. Transparencies and

2" X 2" slides can also be projected to the surface of the desk and picked up by the overhead camera.

A total of five cameras are used to record the live classes on videotape. Refer to the sketch shown in Figure 10 below. Camera #1 is the overhead camera; pan, tilt and rotate in addition to lens functions such as zoom, lens opening and focus can be remotely controlled. Camera #2 is mounted at the rear of the room and also has a remote pan and tilt capability plus zoom, lens opening and focus. It is used to record the instructor at either his desk or the blackboard at the front of the room. However, use of the blackboard is discouraged due to difficulty in following the instructor at the blackboard and the resulting reduction in resolution. Camera #3 is mounted at the front of the room, and its use and design is rather unique. This student camera is servo operated and is used to pick up student questions and faculty-student discussions on the videotape.

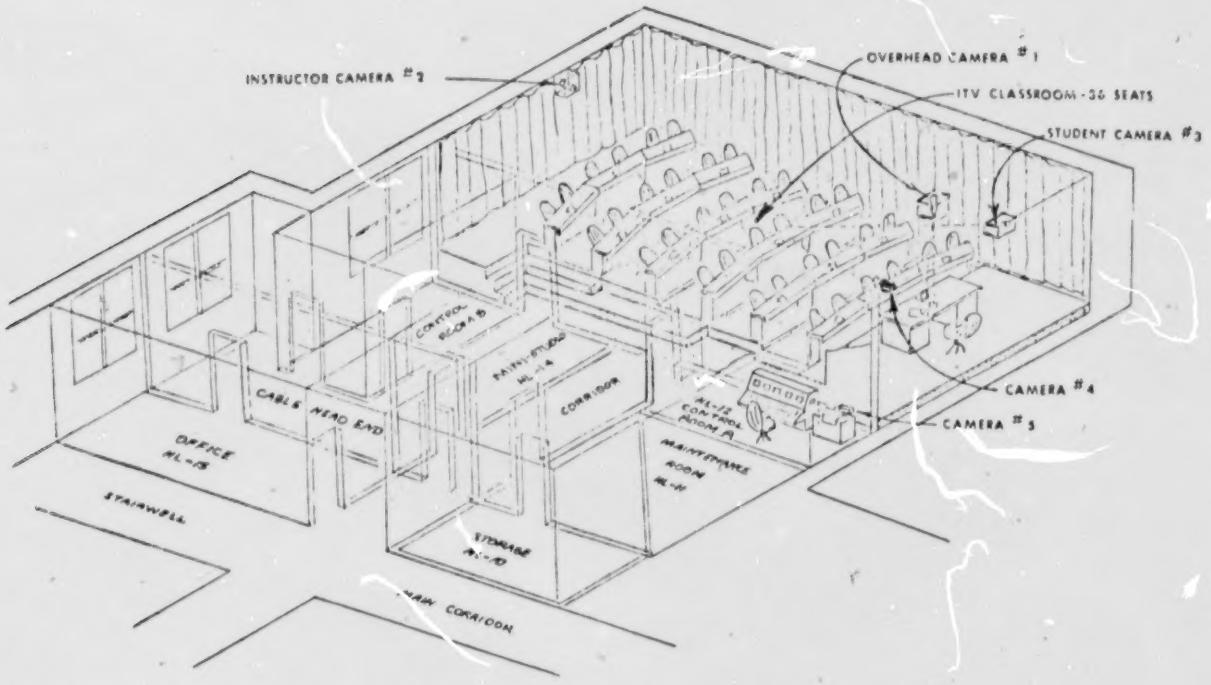

Figure 10. Instructional television classroom showing location of cameras

An electrical engineering student for his Major Qualifying Project designed, constructed and installed the automatic camera positioning system. This servo system utilizes the electronic control of a Pelco pan-tilt unit and a Canon electrically operated zoom lens. An analog positioning servo is used for each of the four

functions (pan, tilt, zoom, focus) as each seat position has associated with it a certain position for each of these functions. The input to these servos is from a system consisting of a read only memory (ROM) and a digital to analog (D/A) converter. This system is used as a memory for the position corresponding to each seat. This memory requires an address code to select the information in the ROM corresponding to the desired seat position. Logic circuitry decodes pushbutton closures to provide this address code. A manual override system is provided to position the system to locations in the classroom other than the discrete student positions.

A student wishing to ask a question engages a button at his desk position. This causes a light to flash on a matrix at the instructor's desk and also on the control console. The instructor or the console operator can activate the servo system by pushing the button with the flashing light. The camera is properly positioned including all lens functions within a matter of seconds, and student participation can be recorded on videotape. The system has been operational since the beginning of D term 1976. Manual control of camera #3 would be difficult and require a longer period of time to zoom in on students.

Camera #4 is a fixed camera with a wide angle lens capable of picking up the entire class. Mounted also at the front of the room, it will be used primarily by the operator in the control room to monitor class activities, but it can also be used to record class discussion on videotape. A Cardiline Very Directional microphone is also mounted at the front of the classroom and is used to pick up audio during student questions and discussions. Camera #5 is located in the control room and is used for adding titles, course numbers, etc.

The Instructional Television Classroom with its associated control room A is designed so that it is possible to make high quality videotapes with ease in a classroom environment. The use of the overhead camera encourages the use of visual aids thereby increasing the quality of the presentation. Furthermore, the pad on the desk can be retained permanently by the instructor for future reference.

Continuing Education Through Videotape (CETV)

A selected number of on-campus graduate courses will be scheduled in the ITV classroom. Classroom activities will be recorded on two 3/4" cassette recorders simultaneously, providing a high resolution master. Two separate recordings will be made as a safety measure to reduce possible problems caused by equipment failure and at the same time provide an additional 3/4" copy for distribution. A title including the name and number of the course, a sequence number and the name of the instructor will be added to each tape; no editing will occur. Duplicate tapes will be made either on 1/2" or 3/4" videotape for distribution (by the most economical method) within 48 hours to off-campus students. Off-campus students will be able to view the videotapes during working hours or on their own time, depending on existing company policy. The company sponsor will have the responsibility for providing a viewing station in a suitable location for the students to view the videotapes. An assigned adjunct faculty member (an employee at each locality) will arrange for the viewing of the videotape and will act as a coordinator working with the faculty members and others at WPI to insure smooth operation of the program. All videotapes will be returned to WPI within three weeks

after the live class is videotaped. All videotapes including the master will be erased and recycled after this three-week period. The cost of videotape prohibits maintaining a complete set of tapes of each course in the program. It is also important that subsequent offerings of the same course be taped before a live class.

The off-campus students will be assigned the same homework problems and will take the same exams as on-campus students. Exams and homework will be sent by mail and distributed and collected with the help of the adjunct instructor. The instructor in each course will also visit the off-campus site at least three times during the course: preferably at the beginning, middle and towards the end of the term. In addition, a minimum of one hour per week will be specified and set aside by the faculty member to receive telephone calls from off-campus students concerning course content and operation. The off-campus student, in consultation with his respective department head, will be able to plan a comprehensive program of graduate study leading to a Master of Science degree. Alternatively, the off-campus student may elect to take an occasional graduate or professional course. The off-campus student or his company will pay the same tuition fees as the on-campus, part-time graduate student.

Experience at other colleges in the United States has demonstrated that a program of this type can be very effective with off-campus students generally doing as well or better academically than on-campus students in the same course. The ability to flexibly schedule class attendance (videotape viewing) time by students who face travel or other commitments seems to more than offset any disadvantages due to not being present at a live presentation.

Summary

At WPI the use of television has grown from the bottom up. Faculty and students saw a need, initiated the use, created the demand; only then was a significant investment made in the systems currently being used. All videotape production at WPI is monochrome, for the cost of adding color cannot presently be justified. Television is being used extensively and effectively at WPI to support the educational program. The program will continue to expand and will remain effective as long as it is supported by the students, faculty and the administration, and the cost is kept within reasonable bounds.